Recycler Backup RF Generator Operation

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During a period in which the Recycler is stashing p-bars, the LLRF system, which generates the RF drive signals for the cavities, may require rebooting for feature upgrades or error recovery. In order to generate ion clearing beam gaps during the reboot process, a backup arbitrary waveform generator is connected to the drive signal to provide a minimal sinusoidal waveform to bridge the time period during which the LLRF is rebooting, approximately 5 minutes. The ARB is frequency locked to the Recycler LLRF system by inputting a 10 MHz master oscillator clock signal to the ARB clock reference. This system has been used with stash sizes up to 230e10 without beam loss. This note describes the proper operation of the backup generator system.

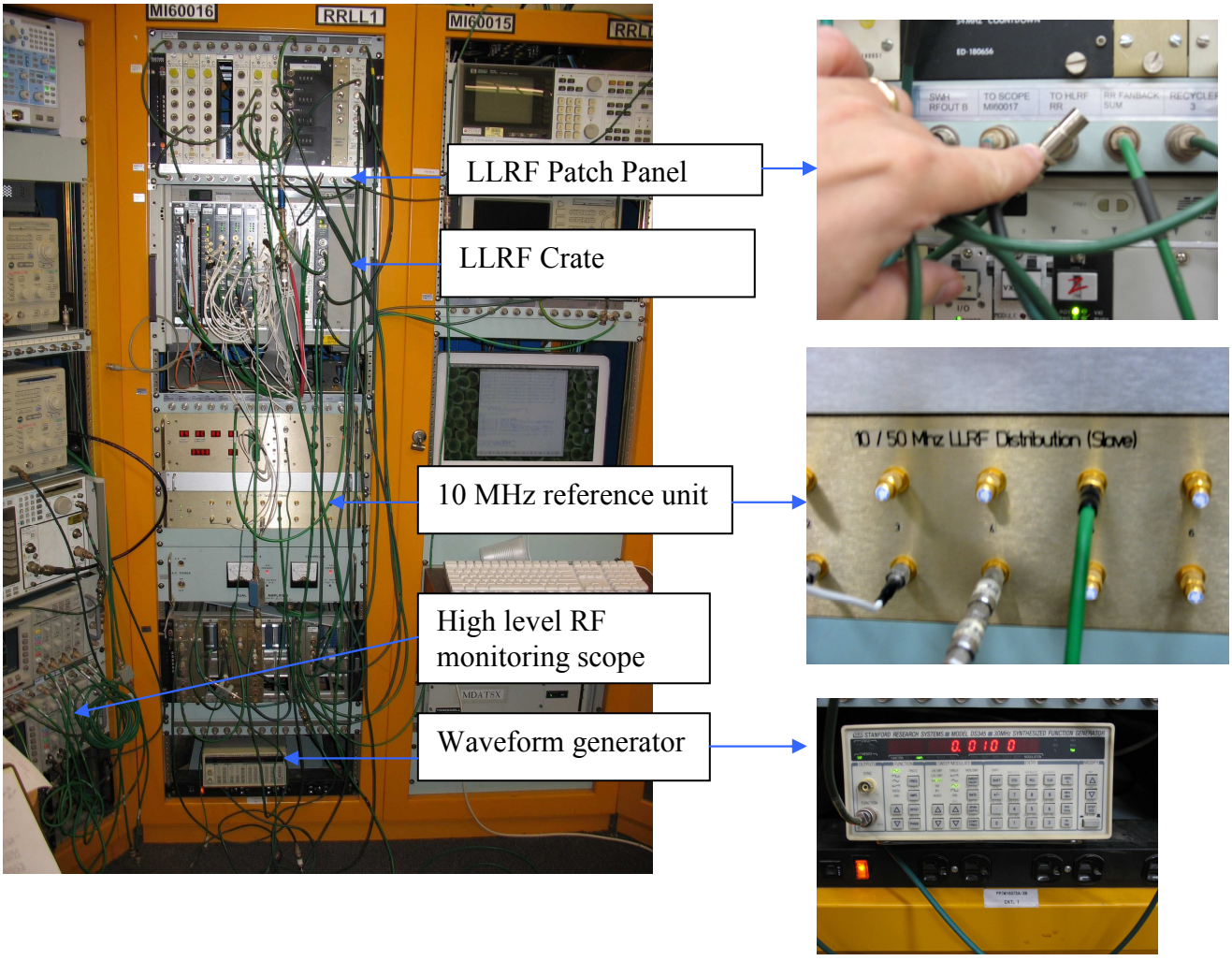
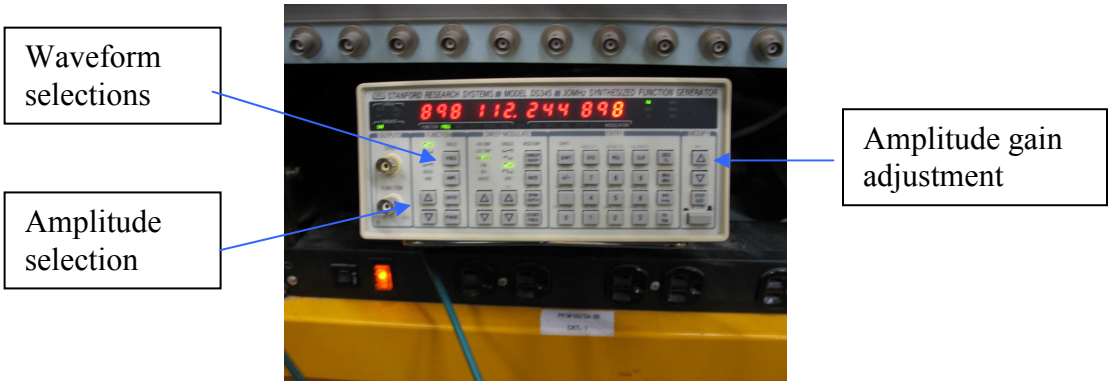


Fig.1 Rack MI60016 (Contains the RRLLRF system and waveform generator)

1. The backup generator, Stanford Research Systems DS345, is located at MI-60 at the bottom of rack MI60016, the same rack as the RRLLRF system. If the generator is not already on it should be turned on. Check to make sure a 10 MHz reference signal cable is plugged into the back of the unit, the 10 MHz reference is obtained from a rack mounted distribution box in the MI60016 rack.

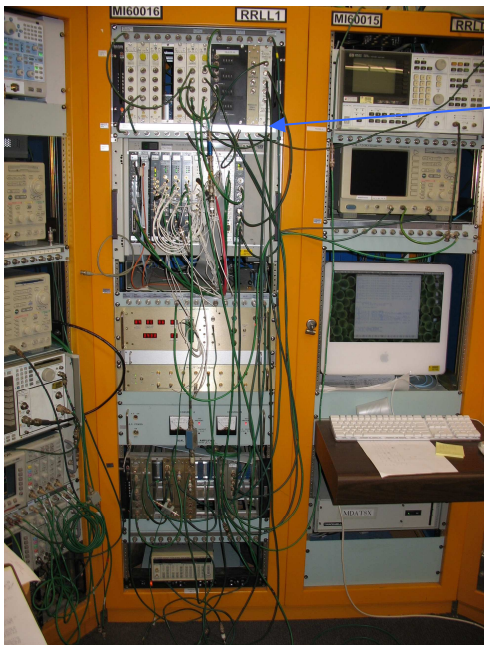
2. The generator should be set to put out a sine wave at the h=10 harmonic of the recycler frequency. To determine this value:
    a. If the RF system is responding then turn off HLRF leveling system by setting R:VRFCED to 0.
    b. The frequency generator should be set to **898112.22 Hz**
    c. The output wave form should be set to **sine wave** and the modulation turned off.

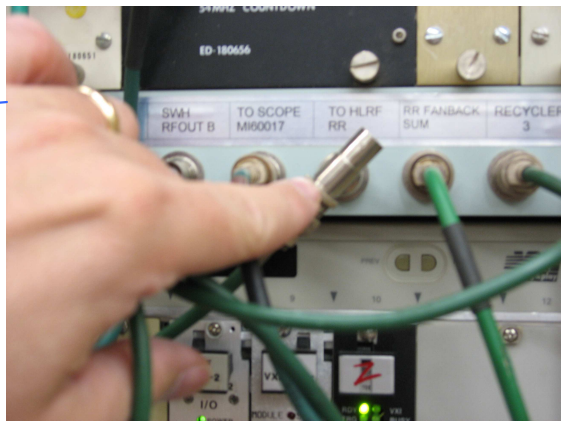


3. The amplitude of the generator should be adjusted to its minimum value.

4. If a LLRF engineer is present, an adjustable potentiometer (blue), stored in the LLRF spares cabinet, should be connected in series with the generator output. The output of the generator should be verified for the proper sine wave with a scope prior to connecting it to the drive signal. Otherwise you can use the Wave from generator's own out put to drive the LLRF signal, just select the amplitude of the waveform being transmitted (see step 6).

5. The generator output (including the potentiometer, if available) should be connected to the HLRF drive on patch panel A–spigot 12. This spigot has a BNC T connector with an empty input installed for this purpose. Patch panel A is located directly above the RRLLRF crate. Do NOT remove the LLRF drive from the BNC T!





6. Turning off the Damper system and the Feed Forward system prior to applying the Stabilizing RF system.

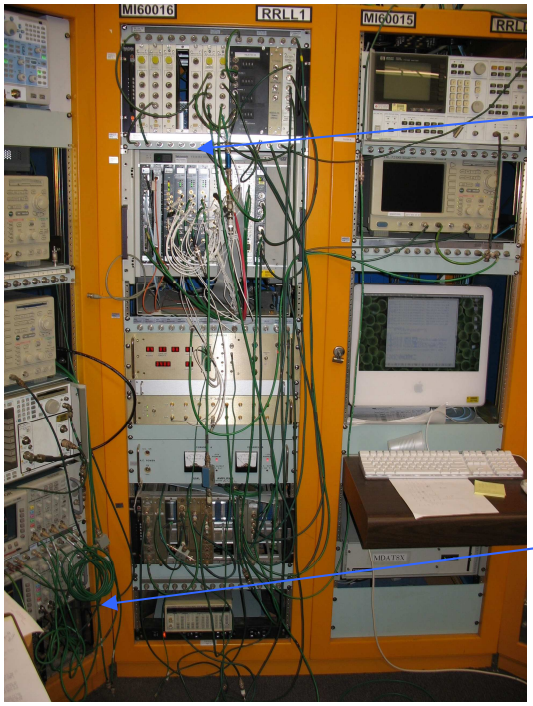
The Damper system is turned off by setting R:RDMODE = 0

The Feed Forward system is turned off by setting R:VRFCED = 0
Once the RF reboot process is completed the Sequencer will turn on the Feed Forward and the Damper systems in the initialize RF sequence.

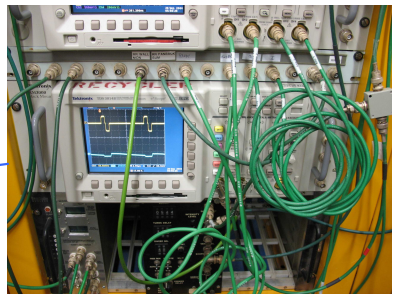
7. The amplitude of the generator can now be raised but should not exceed 1.0 Vpp. Look for about 50% modulation of the fanback and 100% beam modulation. In combination with the potentiometer, this voltage can be coupled into the HLRF

and should be observable as a sine wave on the HLRF fanback signal (CATV Ch. 17 or the Recycler scope).

8. Once the signal is observable and the beam is bunched (Via the scope Labeled Recycler in Rack MI60015) , the LLRF system may be rebooted. If the LLRF system is responding to waveform amplitude control, reduce all ARB channels to zero (if possible). The progress of the reboot can be monitored on the i-Mac next to the LLRF crate, rack MI60017.



Power Switch for the LLRF Front end. Cycling power will reboot system.



Scope Trace that shows High Level output

9. When the LLRF system has fully recovered from the reboot use the Recycler sequencer to run the following aggregates in order, once the Reboot has completed.

i. Initialize RF
ii. Barrier On

This will grow the cold beam buckets back to back producing a gap in the beam. It returns the Beam conditions to back to what we would normally have prior to shot setup, along with turning on the dampers.

Recycler experts are to be called once this has been completed. Depending at what point in the sequencer the system failed further action may be required.

10. Once the LLRF system is generating barrier buckets the backup system voltage should be reduced to zero and disconnected from the HLRF drive spigot. The generator should be turned off and the potentiometer replaced in the LLRF cabinet.